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APPARATUS FOR TRIGGERING RESTRAINT DEVICES

FIELD OF THE INVENTION

The present invention relates to an apparatus for triggering restraint devices.

5 BACKGROUND INFORMATION

German Published Patent Application No. 101 38 764 describes an apparatus for triggering a restraint device featuring crash sensors inside and outside of the control unit. These crash sensors also generate, in addition to the crash signal, a

10 plausibility signal for checking the crash signal.

SUMMARY

By contrast, an apparatus according to an example embodiment of the present invention for triggering restraint devices may

15 provide that vehicle sensors external to the system generate the plausibility signal. These are vehicle sensors located outside of the restraint system, that is, they are neither located within the control unit, nor are they crash sensors located outside of the control unit. This may lead to speed

20 advantages, and may also lead to the complete elimination of the plausibility sensor.

Illustratingly, in the case of a side crash for instance, the plausibility may be assumed as given based on the information

25 "vehicle is skidding" from a vehicle dynamics control system (ESP= electronic stability program). This may eliminate the waiting time prior to the acceleration reaching a central sensor in the control unit of the restraint system. This may represent a significant speed advantage and hence a faster

30 triggering of restraint devices.

                                            SUBSTITUTE SPECIFICATION

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The apparatus may receive the plausibility signal from a knock control system. The engine control unit continuously analyzes the structure-borne sound signal at the engine block to detect engine knock and prevent it through control interventions.

5 This signal may be checked for crash signatures for the purpose of deriving a plausibilization of conventional triggering decision from it. This may eliminate the installation of an additional plausibility sensor.

10 If conventional plausibility sensors are used in addition, an overall plausibility signal may be generated through an OR operation on the plausibility signal of the crash sensor and of the vehicle sensor, which may be drawn upon in the triggering decision.

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Exemplary embodiments of the present invention are shown in the Figures and are explained in more detail in the following description.

20 BRIEF DESCRIPTION OF THE DRAWINGS
Figure 1 is a block diagram of an apparatus according to an example embodiment of the present invention.

Figure 2 is a flowchart of a process running in an apparatus
25 according to an example embodiment of the present invention.

DETAILED DESCRIPTION
Airbags have been part of the safety equipment of motor vehicles for years. For triggering the pyrotechnic system, an
30 algorithm is processed in the software of the electrical control unit. The input variables for this algorithm may be sensor signals for detecting crash severity, for example, acceleration signals and pressure signals, as well as information regarding occupancy, the closing of seatbelt
35 buckles, etc.

To guard against false triggerings due to defective sensors, a principle to be followed is that the triggering decision must be plausibilized. This may be done via an independent sensor.

Two problems may be encountered in the plausibility concepts that may currently be in use:

1. Additional Costs

If, for example, an additional X sensor is used for plausibilizing the acceleration signal in the X direction, i.e., in the direction of travel, costs may be incurred which may only support the safety concept, but which may provide no additional noticeable benefit to the customer.

2. Performance

If, for example, a peripheral sensor is used in the crash zone for detecting a side crash, this may allow for a rapid triggering decision, but subsequently the system may still have to wait for the plausibility of the safety sensor in the central unit. This is due to the fact that accelerations are measurable there only a few milliseconds afterwards.

An example embodiment of the present invention may exploit information quasi external to the system for plausibilizing the crash, instead of using a sensor of the restraint system for plausibilization. This may either lead to speed advantages or possibly even to the complete elimination of the plausibility sensor.

An example of such information external to the system is the signal of the ESP. Based on the information "vehicle skidding", the plausibility may be deduced as given in a side

crash, for example. This may eliminate the waiting time prior
to the acceleration reaching the central sensor.

Another alternative is the structure-borne sound signal of the
5   knock control system. This structure-borne sound signal, which
is continuously recorded, may be checked for crash signatures
to identify a crash or crash-related signals using pattern
recognition. These may serve as plausibility signal.

10   Figure 1 illustrates an apparatus according to an example
embodiment of the present invention in a block diagram. A
control unit 11, which may be mounted at the tunnel of the
vehicle, is connected to a side-impact sensor 10 via a first
data input. Via a second data input, control unit 11 is
15   connected to a side-impact sensor 14 on the opposite side. In
this context, side-impact sensors 10 and 14 may be
acceleration sensors. Alternatively, they may be pressure
sensors that detect an adiabatic pressure increase in a hollow
body in the side panels of the vehicle resulting from the
20   deformation of this hollow body in the course of a side
impact. Other deformation sensors may be used as well for this
purpose. Upfront sensors 12 and 13 attached to the radiator
are connected to control unit 11 via a third and a fourth data
input. These are acceleration sensors that measure the
25   acceleration at least in the direction of travel. It is
possible that they are also capable of measuring accelerations
transverse to the direction of travel, in the Y direction, and
in the vertical direction. Via a fifth data input, control
unit 11 is connected to an ESP control unit 15, and via a
30   sixth data input, control unit 11 is connected to a knock
control system 16.

Control unit 11 itself features a processor memory and its own
sensors to process a triggering algorithm for restraint
35   devices 17 from the crash signals of sensors 10, 12, 13 and

14. Restraint devices 17, to which control unit 11 is connected via a data output, are airbags, seatbelt tensioners, a rollover bar, etc. Sensors 10, 12, 13 and 14 are installed remotely so as to be closer to the crash location. This may

5   allow for faster registration of crash signals. The algorithm running in the processor of control unit 11, however, may also require plausibility signals for detecting failures or errors of crash sensors 10, 12, 13 and 14. For this purpose, control unit 11 may either use signals of the crash sensors

10   themselves, for example, the mutual plausibility of side-impact sensors 10 and 14, or also from sensors within control unit 11 itself, that is, from central sensors. Signals of ESP control unit 15 for controlling the vehicle dynamics and of knock control system 16 may also be used for plausibility. ESP

15   control unit 15 indicates the state of the vehicle dynamics and thus makes it possible to infer a possible crash. Knock control system 16 continuously monitors a structure-borne sound signal at the engine block, and this structure-borne sound signal may also contain crash signatures allowing for

20   the identification of such a crash. If both or one of these are used, then possibly a plausibility via crash sensors may even be eliminated.

Figure 2 illustrates a flowchart of the process running in an

25   apparatus according to an example embodiment of the present invention. The algorithm for generating the triggering decision is executed in block 20. To this end, control unit 11 receives triggering-relevant sensor signals from sensors 10, 12, 13 and 14. At the same time, a plausibility check is

30   performed in blocks 21 and 22. This plausibility check may be performed in block 21 on a conventional plausibility signal, i.e., on a signal of one of crash sensors 10, 12, 13 or 14 or of a central sensor in control unit 11. There, a mechanical switch, for example a Hamlin switch, may be used as well. In

35   addition, a plausibility check is performed in block 22 on the

basis of the signals of ESP control unit 15 or of knock
control system 16. The plausibility checks of blocks 21 and 22
are combined in an OR operation in block 22. That is to say,
if only one of blocks 21 or 22 indicates a plausibility

5   signal, then the output of OR gate 23 will yield a logical
one, indicating the presence of a plausibility signal for a
crash. OR gate 23 is connected to a first input of an AND gate
24. Block 20, which outputs the triggering decision, is
connected to a second input. If the triggering decision is YES

10   and a plausibility signal was detected, then the instruction
to fire is given at the output of AND gate 24. If no
triggering decision was generated or if no plausibility signal
is present, then no firing instruction is issued.

15   Alternatively, it is possible to use only lower block 22, in
which case OR gate 23 may be eliminated. In that case, only
the triggering decision of block 20 and the plausibility check
of block 22 are combined in an AND operation. If both are
present, an instruction to fire is issued. If only one is

20   missing, no instruction to fire is issued.